Material and Methods: 100 CT datasets of cervical cancer patients (stage IB2 – IIIB) receiving HDR application (50 tandem-ovoid and 50 tandem-ring) were studied. The external beam radiotherapy dose was 50Gy. Brachytherapy was delivered using a CT-MRI compatible tandem-ovoid (50 patients) and a tandem-ring applicator (50 patients) to a dose of 8Gy/# in 2fractions. Bladder and rectum were contoured using oncentra planning system. DVHs were calculated and D2cc was recorded for bladder and rectum and compared with the corresponding ICRU point doses. The point B dose, the treated volume, high dose volume and the treatment time was recorded and compared for the two applicators.

Results:

Applicator	Mean D2cc Bladder (Gy)	Mean ICRU Bladder (Gy)	Mean D2cc Rectum (Gy)	Mean ICRU rectum (Gy)	ICRU/D2cc ratio Bladder	ICRU/D2cc ratio Rectum
Tandem-Ring	6.57	5.56	3.95	5	0.847	1.265
Tandem-ovoid	7.30	5.63	4.79	5.65	0.772	1.179

Conclusion: The results indicate that the OAR doses assessed by DVH criteria were higher than ICRU point doses for bladder with both tandem-ovoid and tandem-ring applicators whereas DVH based dose was lower than ICRU dose for rectum. The point B dose, the treated volume and high dose volume was found to be slightly higher with tandem-ovoid applicator whereas the total treatment time was higher with the tandem-ring applicator. The mean D2cc dose for bladder and rectum was lower with tandem-ring applicators. The clinical implication of the above dosimetric differences needs to be evaluated further.

EP-1964

Measurement of vaginal dose with image guided vaginal vault brachytherapy

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Purpose or Objective: The aim of this study is to evaluate an accurate method to define vaginal dose distribution in the delivery of vaginal vault brachytherapy (VBT) utilising a single channel cylinder.

Material and Methods: A retrospective analysis of all 3D single channel cylinder VBT plans held on BrachyVision™ 10.0 treatment planning system obtained between April 2011 and December 2013. All patients received treatment to the top 4cm of the vagina at 0.5cm depth prescription point with fractional doses of 5.5Gy or 7Gy. Dose assessment is conducted using both point dose values and DVH parameters for vaginal wall. A vaginal apex dose point (VAdp) was defined as a midline point on the single channel cylinder, positioned at the apex representing vaginal surface dose (Gy). A second rectal / vaginal dose point (RVdp), positioned 0.5cm posterior to vaginal wall (ICRU rectal point) is also used. This is potentially a good surrogate for vaginal mucosa dose due to its proximity to vaginal cylinder. A presumed vaginal wall thickness of 0.5cm was used to grow a volume representing the upper 4 cm of vaginal mucosa; the D2cc (Gy) and D5cc (Gy) are recorded. Pearson's correlation coefficient is used to calculate correlation between dose point values and dose volume parameters obtained. A p-value <0.05 was considered statistically significant in this study.

Results: A total of 113 CT data sets are analysed. 69% (n = 78) of patients had a prescribed fractional dose of 5.5Gy and 31% (n = 35) received 7Gy fractional dose.

	5.5Gy Fractional Dose		7.0Gy Fractional Dose	
	Mean vaginal fraction dose with SD (Gy)	Range (Gy)	Mean vaginal fraction dose with SD (Gy)	Range (Gy)
D2cc	8.4 ± 0.30	7.71 – 9.81	10.7 ± 0.47	10.03 – 12.84
D5cc	7.8 ± 0.19	7.24 – 8.43	9.91± 0.28	9.21 – 10.77
VAdp	6.31± 0.41	4.30 – 7.54	7.95 ± 0.57	7.17 – 9.84
RVdp	4.0 ± 0.39	3.37 – 6.50	5.03 ± 0.30	4.41 – 5.81

No correlation was identified between RVdp and D2cc for 5.5Gy plans (r=0.004, p=0.974) and 7.0Gy plans (r=0.009, p=0.957). Similarly no correlation was identified between the RVdp and D5cc for 5.5Gy plans (r=0.170, p=0.138) and 7.0Gy plans (r=0.071, p=0.687). The D2cc showed a weak correlation with VAdp for 5.5Gy (r=0.200, p=0.083) and 7Gy plans (r=0.351, p=0.039); however only statistically significant with 7Gy plans. No relationship exists between VAdp and D5cc for 5.5Gy (r=0.146, p=0.202) and 7Gy plans (r=0.068, p=0.699).

Conclusion: The RV dp is not a good surrogate for vaginal dosimetry. The VAdp could possibly be considered to predict D2cc values however dose volume parameters remain the accurate method when recording dose to vaginal mucosa from delivery of VBT.

EP-1965

Quantification of CT planning scans assessing OAR doses when delivering vaginal vault brachytherapy

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Purpose or Objective: The aim of this study is to establish whether one initial CT planning scan for vaginal vault brachytherapy (VBT) patients is adequate to ensure surrounding OAR (bladder, rectum, sigmoid colon and small bowel) do not breach their dose constraints, or whether patients should be CT planned before each VBT fraction due to variations in OAR volumes and organ movement.

Material and Methods: Patients were scanned twice with a segmented single central channel vaginal cylinder in situ. The first CT scan (A) was carried out, as per departmental protocol, two weeks prior to treatment delivery and the subsequent scan (B) on the first day of treatment. All patients were treated using scan A. OAR dose deviations were retrospectively calculated by applying the same dwell positions and loadings to scan B. The total EQD2 OAR dose received by VBT and EBRT was then assessed for tolerance breach (bladder 80Gy; rectum, sigmoid colon and small bowel 70Gy). Both scans were analysed using Pearson correlation coefficient to determine relationships between % differences of OAR volumes and the OAR D2cc dose % differences. Additional bladder, rectum and GI structure (sigmoid colon and small bowel) contours were created combining the two scans (A+B); to simulate the worst case scenario structure movement between treatments.

Results: 42 patients were scanned twice in total. 5 patients were prescribed 21Gy in 3 fractions after 45Gy in 25 fractions EBRT, 27 patients were prescribed 11Gy in 2 fractions after 45Gy in 25 fractions EBRT and 10 patients were prescribed 21Gy in 3 fractions of VBT only. Scan B CT plans showed all patients receiving VBT only or EBRT with 2 fractions of VBT had total EQD2 doses within published OAR dose tolerances. 4 out of 5 (80%) patients treated with EBRT and 21Gy of VBT exceeded at least one OAR dose tolerance and when contours were combined 100% of these patients exceeded at least one

OAR dose tolerance. No relationship was identified between the % difference of OAR volumes and D2cc OAR % variations.

Conclusion: Patients treated with 45Gy in 25 fractions EBRT + 21Gy in 3 fractions VBT are at greater risk of breaching OAR dose tolerances when using a single planning scan for all treatments. There is no significant relationship between the % difference of bladder, rectum, sigmoid and small bowel volumes and % dose difference. The OAR dose variation between each scan is most likely due to the unpredictable day to day movement of the structure and cannot be replicated by standardised organ filling procedures. Departmental protocols have been amended to CT plan this subgroup of patients before each treatment fraction to take into account position of structure at that time. Use of a multichannel applicator could also help minimise the dose to these structures.

EP-1966

Late toxicity outcomes of CT-based brachytherapy planning for locally advanced cervical cancer

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Purpose or Objective: A report of late rectal and bladder toxicitiy outcomes of a computed tomography(CT)-based image guided brachytherapy(IGBT) technique for treatment of cervical cancer.

Material and Methods: Between 2008-2014, 95 women with International Federation of Gynecology and Obstetrics stage IB to IVA cervical carcinoma treated with definitive concurrent cisplatin based chemotherapy and external beam radiation therapy (EBRT) 50.4Gy in 28 fractions followed by 3-4 fractions of high-dose-rate (HDR) IGBT was retrospectively reviewed. At each implantation, all patients had a urinary catheter insitu and received bowel enema before undergoing planning CT-simulation. A high-risk clinical target volume (HRCTV) encompassing any visible tumor and the entire cervix, rectum and bladder was contoured on the simulation CT according to Radiation Therapy Oncology Group Gynaecology Contouring Atlas. Prescription dose range of 5.5-7Gy was prescribed to the HRCTV. Doses to Point A, ICRU rectal and bladder points were recorded. Toxicities were recorded using NCI-CTCAE version 3.

Results: The median follow-up time was 29 months. The mean Point A dose was 6Gy (4.6-7.6Gy). The ICRU rectum and bladder points were 4.69Gy (2.5-5.7Gy) and 4.23Gy (1.95-7.2Gy) respectively. 22 patients(23%) and Grade 2 proctitis and 10 patients(11%) had Grade 3 proctitis. 4 patients (4%) had Grade 2 cystits and 2 patients(2%) had Grade 3 cystitis. No patients had ≥ Grade 4 toxicity.

Conclusion: Despite bladder and bowel preparation protocol, late rectal toxicity was significant in a high proportion of patients. Implementation of an interstitial IGBT using the EMBRACE protocol might help to limit these late rectal toxicities.

EP-1967

Preliminary results of a new brachytherapy schedule in postoperative endometrial carcinoma

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Purpose or Objective: To analyze the preliminary results of a new daily high-dose-rate brachytherapy (BT) schedule in vaginal-cuff relapse (VCR) and toxicity in postoperative endometrial carcinoma (EC).

Material and Methods: From September 2011 to December 2014, 102 patients (p) were treated with HDRBT in FIGO stages: IA-30p, IB-39p, II-8p, IIIA-4p, IIIB-1p, IIIC1-8p, IIIC2-5p, IIIC3-1p, IVB-6p. Pathology: 79/102 endometrioid adenocarcinoma and 23/102 other types. Radiotherapy: Group 1: 74p/102p 1 BT fraction of 7Gy after external beam irradiation (mean 45Gy, range 44.0-50.4); Group 2: 28p/102p BT alone by 3 daily fractions of 6Gy. Chemotherapy: 20/102 patients. Toxicity evaluation: RTOG scores for bladder and rectum and the objective criteria of LENT-SOMA for vagina. Statistics: Chi-square and Fisher exact tests.

Results: Mean age (years): Group 1: 65.4 (40-88), Group 2: 66.7 (39-90). Mean follow-up (months): Group 1: 24.48 (8.04-52.56); Group 2: 26.88 (8.76-54.48). VCR: No relapses with the present mean follow-up. Toxicity: Group 1 - early problems (all G1-2) in rectum (5.5%), bladder (6.8%) and vagina (14.9%). Late toxicities: rectum 2.7% (all G1), bladder 0% and vagina 27% (G1-G2). Group 2 -early toxicity: bladder 10.7% (all G1), vagina 28.1% (all G1-G2), rectum 0%; late toxicity was only found in vagina in 17.8% (G1-2). No significant differences were found in toxicities between the two groups.

Conclusion: The present brachytherapy schedule consisting in 1 fraction/7Gy after external beam irradiation and 3 fractions/6Gy administered daily seem a safe regime in terms of local control and toxicity for postoperative EC. These results seem similar to those found in our Hospital in 2 previous series with low dose per fraction and an increased number of fractions. Grant: AECC Foundation

EP-1968

Vaginal mucosal doses in the treatment of cervical cancer using HDR brachytherapy

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Purpose or Objective: To develop a reliable method of determining the radiation dose to the vaginal mucosa in the treatment of cervical cancer.

Material and Methods: Forty six cervical cancer patients were treated with EBRT and HDR brachytherapy therapy from July 2010 – Dec 2013. They received 45Gy in 25 fractions of EBRT to the entire pelvis followed by 3 HDR brachytherapy fractions using a tandem and ring applicator with a HRCTV D90 of 80-85Gy. A volume to represent the vaginal mucosa was obtained by using a non-uniform expansion of the 5mm ring applicator cap; this was expanded by 5.0 mm in all directions except the sup/inf which was expanded by 7.0 mm. In addition, a rectal vaginal (RV) point dose was determined using a point 5.0 mm posterior to the intersection of the superior-posterior junction of the build up cap (figure 1 sagittal view). Total doses were calculated for vaginal volumes of 5.0cc (D5 v), 2.0cc (D2 v), and the RV point. In addition, the slope was calculated for the vaginal mucosa between D5 v and D2 v. Pearson correlation coefficients (with p values = 0.01) were assessed to identify